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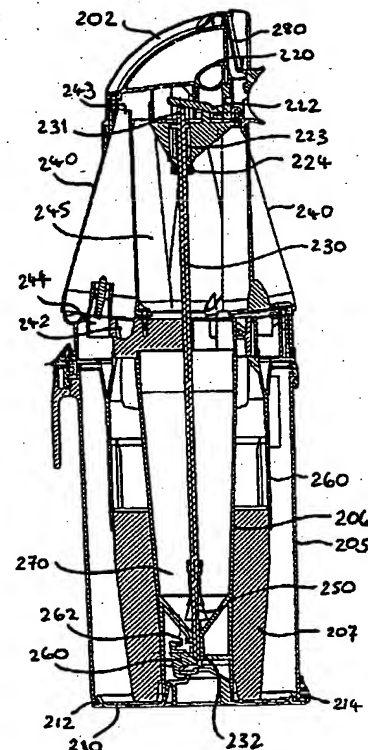
(56) Documents Cited
GB 2317122 A
US 5090976 A
US 5145499 A

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Online: WPI, EPODOC, PAJ

(54) Abstract Title
Collecting chamber for bagless vacuum cleaner, with dust agitator

(57) A bagless, preferably cyclonic, vacuum cleaner comprises a separating unit [20], for separating dirt and dust from incoming airflow drawn in by the vacuum cleaner. The separating unit includes a chamber 205 in which dirt and dust collects in collection area 270 and also in the annular space between outer wall 205 and inner wall 206. The lower wall 210 of the chamber is pivotally attached and can be opened by manually operating trigger 220 which acts on a push rod 230 which in turn acts on a catch 260. Dirt collecting in area 270 can become consolidated so that when the chamber is removed from the cleaner and placed over a receptacle, and the door 210 opened, it can fall to fall out. To assist, the push rod is provided with an agitator such as triangular fins 250, so that when the door 210 is open, repeated actuation of the trigger 220 causes the fins to move up and down and break up the consolidated dust and dirt so that it drops out. Since the trigger actuating the agitator is remote from the open end of the chamber the user is not in danger of getting their hands dirty.

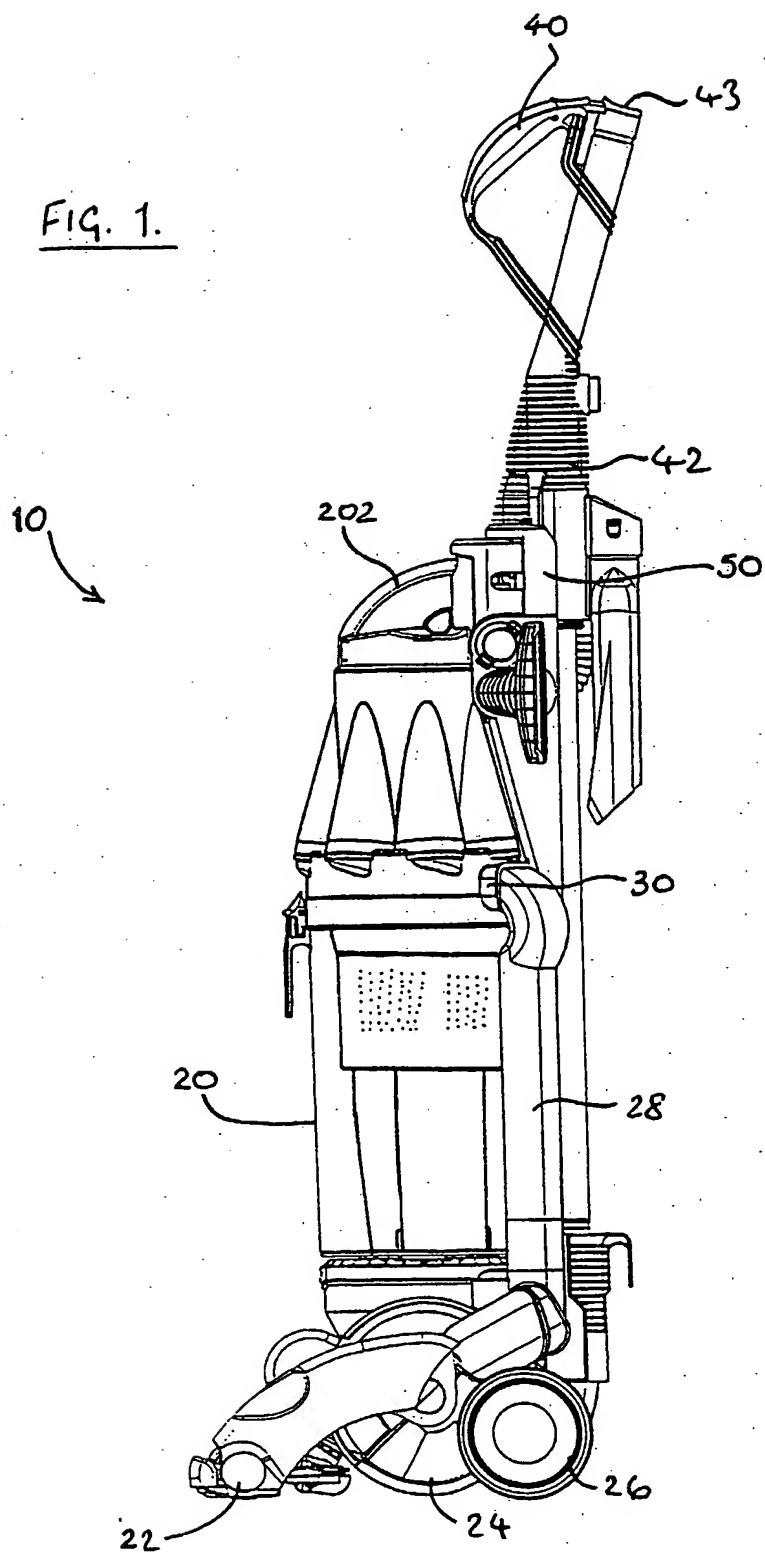
FIG. 3



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FIG. 1.



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FIG. 2

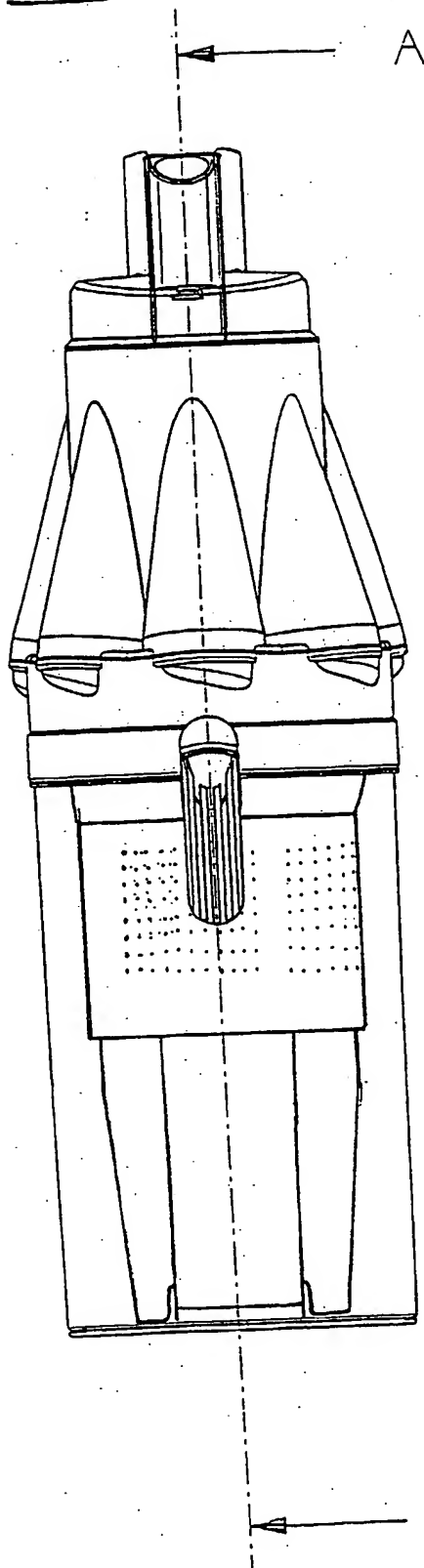
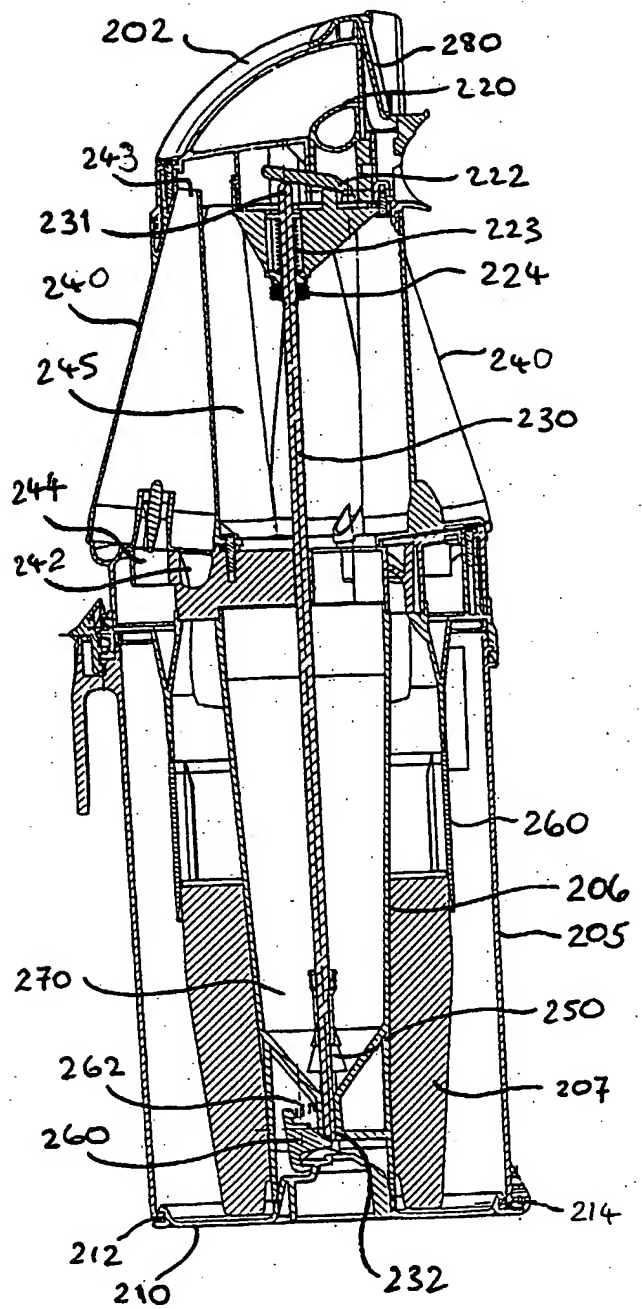


FIG. 3



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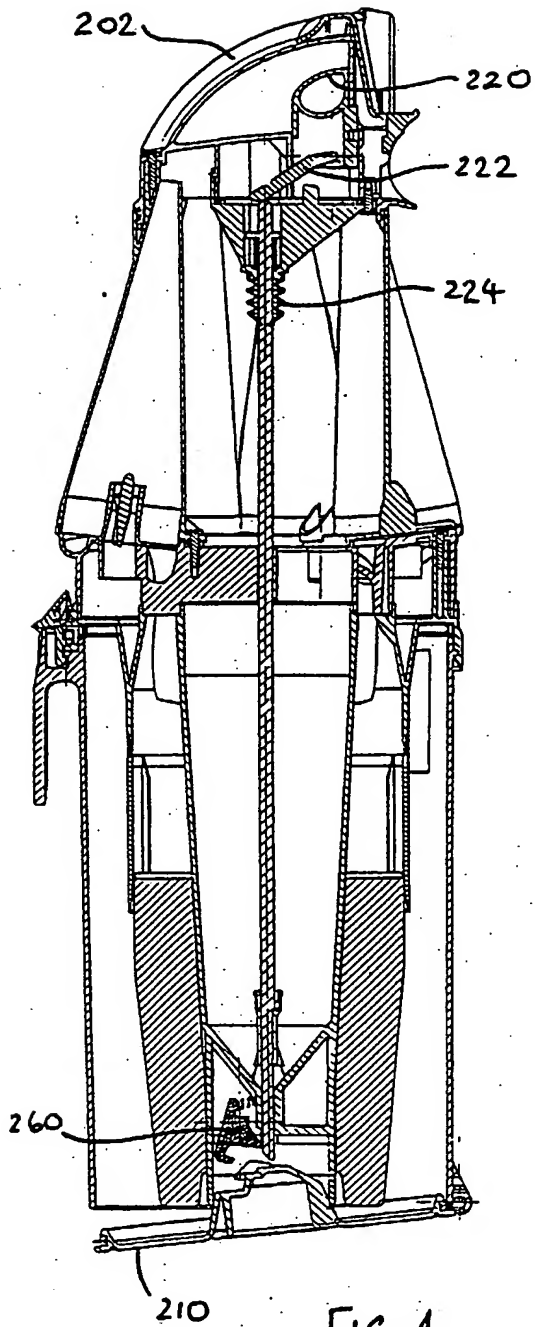


FIG. 4

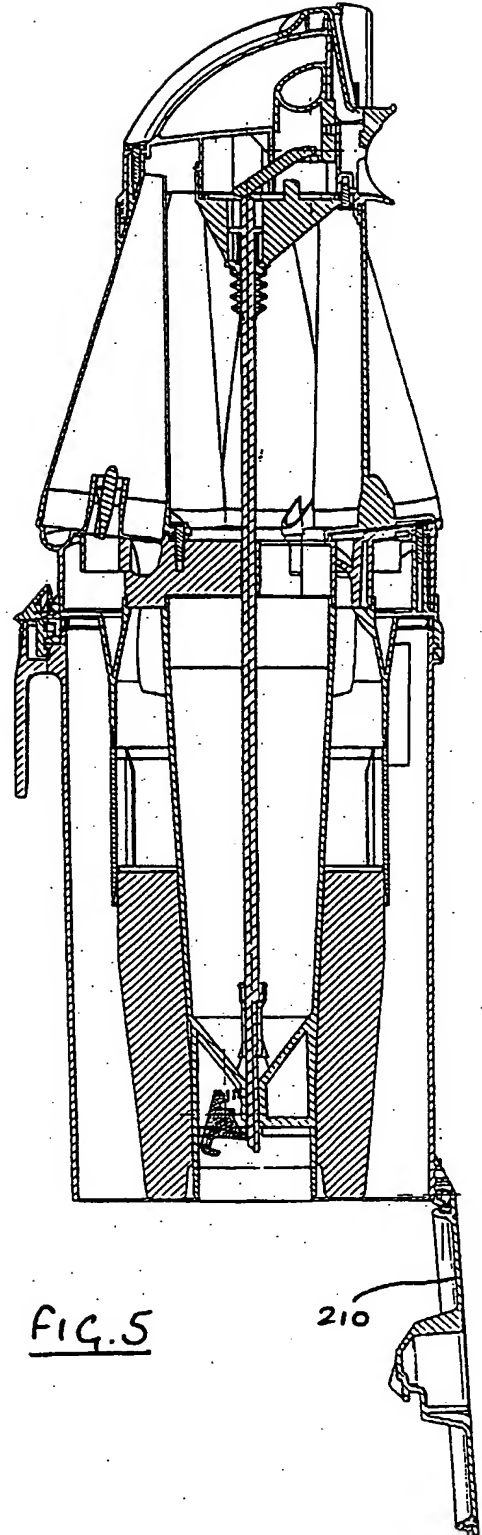
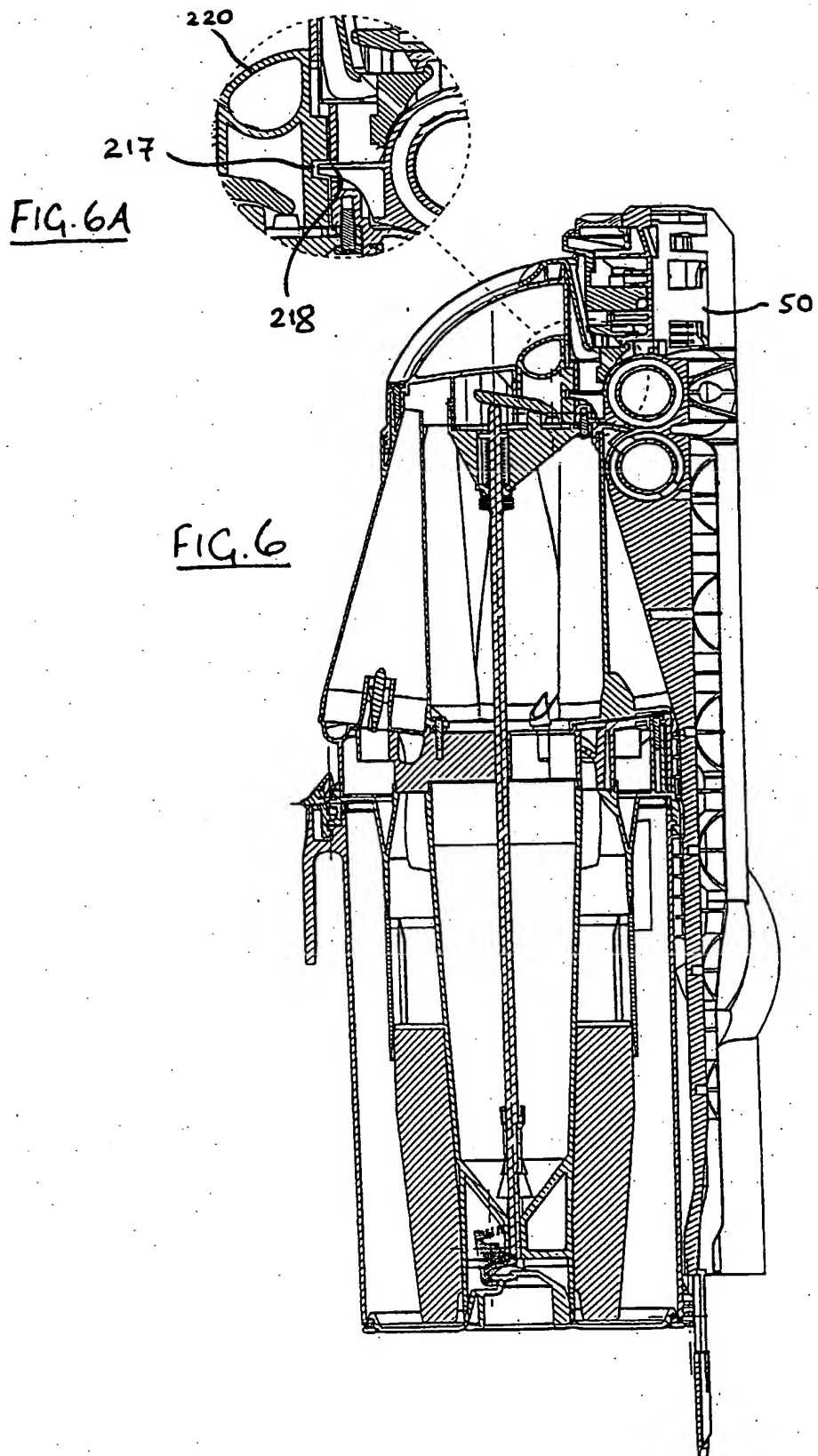


FIG. 5

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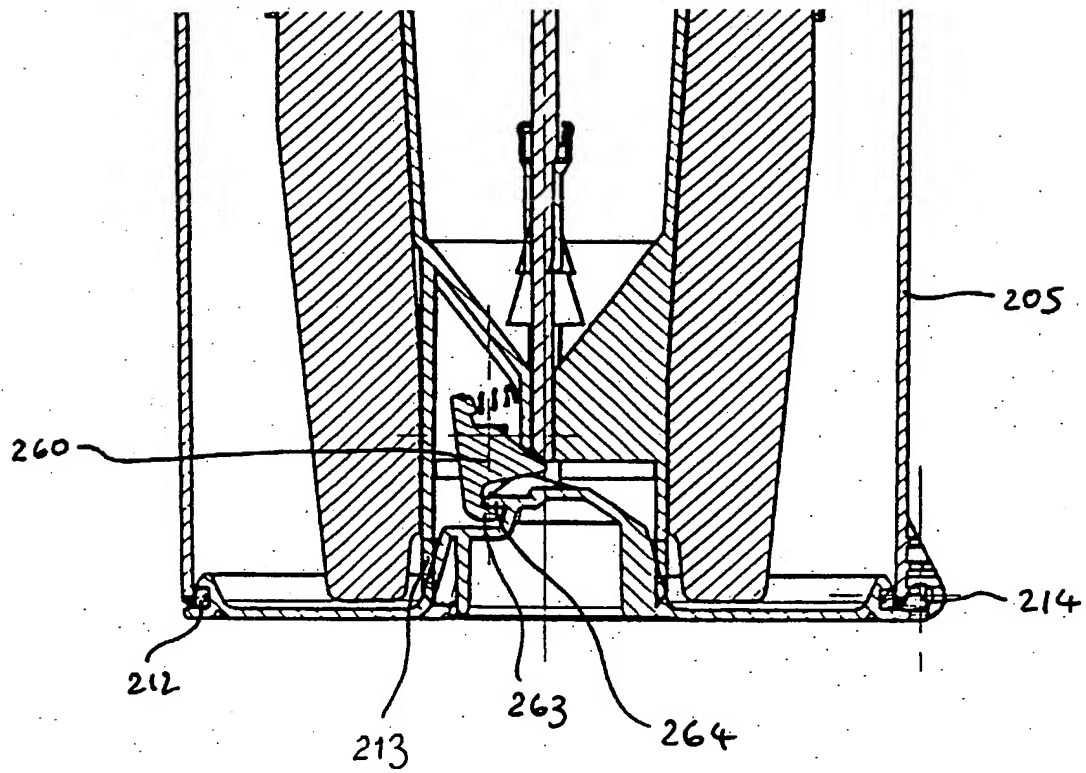
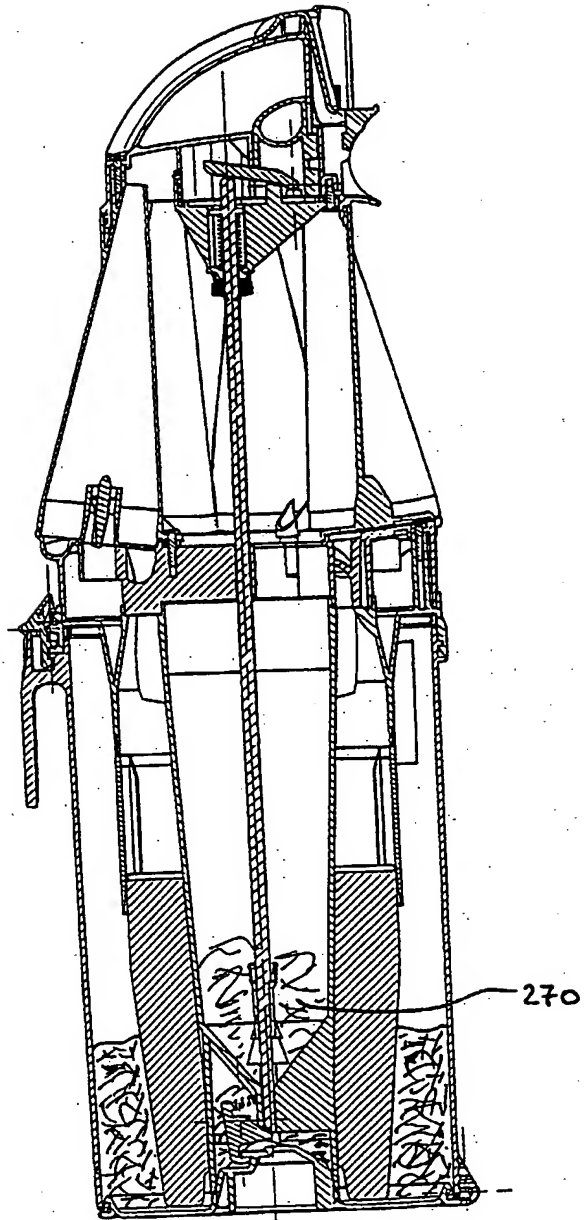


FIG. 7

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FIG. 8



A Collecting Chamber for a Vacuum Cleaner

This invention relates to a collecting chamber for a bagless vacuum cleaner and to a vacuum cleaner which incorporates the collecting chamber.

5 Vacuum cleaners which separate dirt and dust from an airflow without the use of a filter bag, so-called bagless vacuum cleaners, are becoming increasingly popular. Most bagless cleaners use cyclonic or centrifugal separation to spin dirt and dust from the airflow. By avoiding the use of a filter bag as the primary form of separation, it has
10 been found possible to maintain a consistently high level of suction, even as the collecting chamber fills with dirt.

The principle of cyclonic separation in domestic vacuum cleaners is described in a number of publications including EP 0 042 723. In general, an airflow in which dirt and
15 dust is entrained enters a first cyclonic separator via a tangential inlet which causes the airflow to follow a spiral or helical path within a collection chamber so that the dirt and dust is separated from the airflow. Relatively clean air passes out of the chamber whilst the separated dirt and dust is collected therein. In some applications, and as described in EP 0 042 723, the airflow is then passed to a second cyclone separator which is
20 capable of separating finer dirt and dust than the upstream cyclone. The airflow is thereby cleaned to a greater degree so that, by the time the airflow exits the cyclonic separating apparatus, the airflow is almost completely free of dirt and dust particles.

While bagless vacuum cleaners are successful in maintaining a consistently high level
25 of suction, the absence of a bag can make it difficult to dispose of the dirt and dust which is collected by the cleaner. When the separating chamber of a bagless cleaner becomes full, a user typically removes the collecting chamber from the chassis of the machine, carries the chamber to a dust bin or refuse sack and tips the chamber upside down. Often dirt and dust is densely packed inside the collecting chamber and it may
30 be necessary for a user to manually dislodge the dirt by reaching into the chamber and pulling at the collected mass of dust and fibres, or to shake or bang the collecting

chamber against the side of a dustbin. In some cases, this can cause a fair amount of mess.

5 Some solutions to this problem have been proposed. US 5,090,976 describes the use of a disposable liner which can be fitted inside the cyclonic separating chamber. When the liner is full, the liner is lifted out of the chamber and disposed of. WO 98/10691 describes a cyclonic collection chamber where a bag is retained, in a collapsed state, in the base of the collection chamber. When the collection chamber is full, the base is unscrewed from the chamber so that the bag can extend downwardly from the base.

10 Dirt and dust slides out of the collecting chamber into the bag and the bag can then be sealed and separated from the collecting chamber for disposal. Both of these solutions have a disadvantage in that they require a user to keep a supply of spare bases or liners, which adds to the cost of maintaining the machine.

15 EP 1 023 864 describes a dust-collecting device for a cyclonic vacuum cleaner. The dust-collecting chamber can be removed from the chassis of the cleaner for emptying. A bottom lid of the dust-collecting chamber is attached by way of a hinge to the remainder of the chamber and the lid can be released by pressing a release button. A ribbed cylindrical filter is fitted inside the dust-collecting chamber and is rotatable

20 within the chamber to encourage the release of dirt which is stored in the chamber. A separate control is provided for operating the filter.

The present invention seeks to provide a bagless vacuum cleaner in which collected dirt and dust which is more convenient to use.

25

Accordingly, a first aspect of the present invention provides a collecting chamber for a bagless vacuum cleaner comprising an inlet for receiving a dirt-laden airflow, an air outlet, a collection area for collecting, in use, dirt and dust which has been separated from the airflow and wherein part of the chamber wall in the region of the collection

30 area is a closure member which is movable between a closed position in which the closure member seals the chamber and an open position in which dirt and dust can

escape from the collection area, the chamber further comprising releasing means for releasing the closure member from the closed position, the releasing means comprising a manually operable actuating member and an agitator for agitating dirt held within the collection area, wherein the agitator is operable by the actuating member.

5

The agitator helps to dislodge any dirt that may have become 'stuck' in the collection area. By arranging the agitator to be operable by the actuating member a user does not need to separately operate the release means and the agitator. This considerably increases convenience for a user and ensures that the chamber is reliably emptied on each occasion.

10

The term 'bagless' is intended to cover a broad range of vacuum cleaners which have a reusable collecting chamber, and includes, inter alia, cleaners which separate dirt and dust by way of cyclonic, centrifugal or inertial separation.

15

Preferably the closure member remains coupled to the chamber, such as by a pivotal coupling. Thus, a user does not need to struggle with refitting the closure member and there is no risk of the closure member falling into a dust bin or refuse sack along with the dirt and dust which is released from the separator.

20

It is convenient for the actuating member to be located adjacent a handle for carrying the separator. This allows a user to carry and empty the separator with one hand.

Preferably the separator is removable from a stowed position on a chassis of a vacuum cleaner and the actuating member is inhibited from opening the closure member when the separator is in the stowed position. This prevents accidental release of the closure member, which may cause dust to escape from the separator.

25

Preferably the closure member is pivotably fixed to the chamber. However, it is also possible for the closure member to be slideably movable with respect to the chamber.

30

The separator is preferably a cyclonic separator where dirt-laden air is spun at high speed to centrifugally separate dirt from the airflow but it can be any form of bagless separator where the collection chamber is reused after it has been emptied.

- 5 The separator can have more than one separation stage. Preferably the collection areas of the first, second (and further) stage separators each lie adjacent the closure member such that all of the collected dirt and dust can be readily emptied from the separator.

- 10 A further aspect of the invention provides a vacuum cleaner incorporating a separator of the kind described above.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

- 15 Figure 1 shows a bagless vacuum cleaner;

Figure 2 shows just the dirt and dust separation unit of the vacuum cleaner of Figure 1;

- 20 Figure 3 is a cross-section along line A-A of the dirt and dust separation unit of Figure 2, with the base of the unit in a closed position;

Figure 4 shows the same cross-section as Figure 3 but with the base in a partially open position;

- 25 Figure 5 shows the same cross-section as Figure 3 but with the base in a fully open position;

Figure 6 is a cross-section through the dirt and dust separation unit mounted on the chassis of the vacuum cleaner;

Figure 6A is a more detailed view of the same cross-section as Figure 6, showing the feature on the chassis which inhibits movement of the trigger release mechanism;

Figure 7 is a more detailed view of the lower part of the cross-section of Figure 3; and,

Figure 8 shows how dirt and dust accumulates in the dirt and dust separation unit.

Referring to Figures 1 to 3, a vacuum cleaner 10 has a main chassis 50 which supports dirt and dust separation apparatus 20. The lower part of the cleaner 10 comprises a cleaner head 22 for engaging with the floor surface. The cleaner head has a downwardly facing suction inlet and a brush bar is mounted in the mouth of the inlet for agitating the floor surface. The cleaner head is pivotably mounted to a motor housing 24 which houses the motor and fan of the cleaner. Support wheels 26 are mounted to the motor housing for supporting the cleaner and allowing movement across a floor surface. A spine of the chassis 50 extends upwardly from the motor housing 24 to provide support for the components of the cleaner. A cleaning wand 42 having a second dirty air inlet 43 is connected by way of a hose (not shown) to the chassis at the base of the spine 50. The wand 42 is releasable from the spine 50 so as to allow a user to carry out above-the-floor cleaning and cleaning in places which are inaccessible by the main cleaning head 22. When the wand is fixed to the spine 50, the wand 42 forms the handle of the cleaner and a handgrip 40 at the remote end of the wand 42 allows a user to manoeuvre the cleaner. These features of the cleaner are well known and have been well documented elsewhere and can be seen, for example, in cleaners which are manufactured by DYSON™, and thus will not be described in any further detail.

Dirty air from the cleaner head 22 or wand inlet 43 is carried to the separator unit 20 by inlet conduit 28 and inlet 30. Separator 20 is a cyclonic separator which spins dirt, dust and other debris out of the airflow by centrifugal separation. One particular form of separator unit 20 is shown in detail in the figures as a preferred embodiment but it should be understood that there are many other ways in which the separator could be constructed. In the illustrated separator unit 20, airflow passes through a first separation

stage and then a second separation stage. The first separation stage is a substantially cylindrically-walled cyclonic chamber 205 whose purpose is to separate large debris and dirt from the airflow. Inlet 30 is arranged to direct dirty air into the chamber 205 in a tangential direction to the wall of the chamber. Fins or baffles 207 extend radially
5 outwardly from a central core of the chamber and serve to discourage separated dirt or dust from becoming re-entrained in the airflow when the vacuum cleaner is first started. The outlet of the first separation stage is a shroud 260, i.e. an apertured annular wall mounted coaxially inside the chamber 205. The area on the inner side of the shroud leads to the second separation stage. The second separation stage is a set of tapered
10 cyclonic chambers 240 which are arranged in parallel with one another. Each cyclonic chamber 240 has a tangential inlet 242, an outlet 243 for separated dirt and dust and a cleaned air outlet 244. Each of the cleaned air outlets 244 of the cyclonic chambers 240 communicate with an outlet conduit such that air from the individual outlets of the parallel cyclonic chambers is recombined into a single flow. The outlet conduit mates
15 with a port on the chassis spine 50 when the separator unit 20 is fitted to the chassis.

In use dirty air which is laden with dirt, dust and other debris enters the first separation stage via inlet 30 and follows a spiral path around the chamber 205. The centrifugal force acting on the material in the airflow causes the larger debris and dirt to be
20 separated from the airflow. This separated material collects at the base of the chamber 205, against base 210, due to a combination of gravity and the pressure gradient which exists in chamber 205 while the cleaner is in operation. The airflow passes through the shroud 260. The shroud 260 causes air to perform a sharp change of direction and causes fibrous material to collect on the outer wall of the shroud 260. The airflow
25 passes to the second separation stage where it is divided between the cyclonic chambers. Air enters a respective one of the chambers via a tangential inlet and is then constrained to follow a spiral path of decreasing radius which greatly increases the speed of the airflow. The speed is sufficient to separate dirt and extremely fine dust from the airflow. The separated dirt and dust exits the cyclonic chambers 240 via outlets 243
30 which communicate with a central conduit 245. Dirt and dust falls, under gravity, towards the base of conduit 245 and collects at the lower end of the conduit 245

adjacent the base 210 in region 270 (Figure 8). Cleaned air from the parallel chambers 245 is recombined into a single flow and is channelled out of the separator unit 20, down the spine 50 of the chassis and through a pre-motor filter, fan and post-motor filter before finally being exhausted from the cleaner.

5

It should be understood that the second separation stage need not be a set of parallel cyclonic chambers 240. The second separation stage could be a single tapered cyclonic chamber which can fit inside the cylindrical chamber of the first separation stage, as shown in EP 0 042 723. Alternatively, the second separation stage could be a further
10 cylindrical cyclone or it could be omitted altogether. The first separation stage may be a tapered chamber rather than the cylindrical one described. However, in each of these alternatives, dirt and dust will be separated from an airflow without the use of a filter bag and will collect in a collection area.

15 The separator unit 20 is supported by the chassis 50 and is releasably held upon the chassis by a catch 280, shown more clearly in Figure 6A. The separator unit 20 is shown by itself in Figures 2 - 5. The separator unit 20 is releasable from the chassis to allow the separator to be emptied. A handle 202 is provided at the top of the separator unit 20 for allowing a user to carry the unit 20. The base 210 of the separator unit is
20 movable between a closed position (shown in Figures 2, 3) and an open position (shown partially open in figure 4 and fully open in Figure 5) to permit emptying of the unit 20. The base 210 is hinged 214 to the cyclone chamber 205 to allow pivotal movement between the base 210 and chamber 205. Two separate collection areas lie adjacent to the base 210. The first collection area is the annular region between the cylindrical
25 chamber wall 205 and the inner wall 206 at the lower end of the separator. The second collection area 270 is the area within the tube-like part 206. Thus, when base 210 opens, material empties from both of the collection areas. The outer annular edge of the base 210 has a radially inwardly extending slot to hold a seal 212. In use, with the base closed, the seal 212 fits tightly against the inner wall of the chamber 205 to maintain an
30 air and dust-tight seal. A second seal 213 extends axially outwardly from the lower annular edge of part 206 such that it fits tightly against the axially extending wall of the

raised central cap of the base 210. Seals could be located in other positions to achieve the same sealing effect of the base. The base 210 is held in the closed position by a lock mechanism 260, 262. The locking mechanism is controlled by a manually operable trigger 220. A linking mechanism 222, 223, 224, 230 joins the trigger 220 to the lock
 5 mechanism. Trigger 220 is received in a vertically extending channel on the spine-facing side of the separator which confines the trigger to follow a vertical movement. A lug on the trigger cooperates with a lever arm 222. The lever is pivotably fixed to the housing such that the remote end of the lever arm pushes downwardly against the upper end 231 of push rod 230. The push rod 230 is resiliently biased by spring 223 in the
 10 position shown in Figure 3 and can be displaced downwardly (to the position shown in Figure 4) against the action of the spring 223 when the trigger is pulled. Spring 223 is held in a cavity of the housing and respective ends of the spring 223 act against the end wall of the cavity and the flange which is carried by the push rod 230 near end 231. The linking mechanism is shielded from dust by a gaiter 224, which is attached to the push
 15 rod 230 and the housing of the separator unit. The gaiter 224 stretches as the push rod moves downwardly, maintaining a dust-tight shield for the mechanism behind the gaiter 224.

The lowermost end of the push rod has an inclined face which cooperates with a
 20 similarly inclined face on the catch 260 at the base. Catch 260 is pivotably mounted to the base and can be displaced, against the bias of spring 262, to the position shown in Figure 4. The catch has a hook 263 which engages with a corresponding hooked feature 264 on the central part of the base 210 so as to hold the base 210 in the closed position. The lowermost surface of the catch 260 is curved such that when the base 210 is pushed
 25 towards the closed position the catch 260 is displaced, allowing the hook 264 on the base 210 to engage with the hook 263 on the catch 260.

It will be appreciated that the trigger, linking mechanism and lock can be realised in many alternative ways. For example, the trigger 220 could be linked directly to the
 30 push rod 230, rather than being indirectly linked by the lever 222.

The lower end of the push rod 230 also carries an agitator 250. The agitator 250 is fixed to the push rod and thus moves upwardly and downwardly with the push rod as the trigger 220 is operated. In use, a plug of dirt and dust may form at the lower end of the second collection area, next to base 210. The agitator 250 has radially outwardly
5 extending fins. In use, movement of the agitator will either push the plug or break the plug into smaller parts which can then fall out of the collection area. The inner surfaces of the collection tube are smooth and tapered to discourage dirt from settling. The agitator could be more elaborate than the one shown here. For example, the agitator could be arranged to rotate about the longitudinal axis of the push rod 230 as the push
10 rod moves upwards or downwards. A second agitator could be provided in the first collection area, the second agitator also being linked to the push rod or release mechanism. The cutting effect of the agitator on a plug of material can be improved by forming sharp or pointed edges on the agitator.

15 To ensure an air and dust-tight seal around the base, the seal 212 fits tightly against the chamber. This may cause the base to 'stick' in the closed position when the catch 260 is released. The push rod 230 has a sufficient length such that, when it is operated, it moves downwardly towards the catch 260, operates catch 260 and then continues to move towards the base 210, pushing against the base, overcoming the resistance of the
20 seal 212 against the chamber wall 205 and thus pushing the base 210 open.

In use, a user removes the separator unit 20 from the chassis by operating release member 280 and carries the separator unit 20, by way of handle 202, to a dust bin or refuse sack. The lower end of the separator unit is held over or within the dust bin or
25 sack and the trigger 220 is pulled. This causes the base 210 to swing open and dirt, dust and debris which has been collected in the chamber 205 falls out of the unit 20 into the bin. Due to the distance between the handle and base, and the direction in which the dirt falls from the unit 20, a user is not brought into contact with the dirt. As the dirt collects against the part of the chamber which opens, i.e. base 210, the dirt falls out of
30 the chamber 205 with little or no additional effort by a user. Fine dust collected within

the second stage collector 270 can be fully cleared by the user operating trigger 220 several times. This will operate agitator 250.

5 Figure 6 shows the separator unit 20 in position on the chassis 50 of the cleaner 10. To ensure that the base 210 is not accidentally opened when the cleaner is in use, the chassis 50 has a projection 218 which fits inside a notch 217 on the trigger 220 when the separator unit 20 is fitted to the chassis 50. Thus, the trigger 220 is inhibited from operating.

10 In the arrangement shown in the drawings the base 210 is pivotably fixed to the chamber. It would also be possible for the base to be slideable with respect to the chamber.

Claims

1. A collecting chamber for a bagless vacuum cleaner comprising an inlet for receiving a dirt-laden airflow, an air outlet, a collection area for collecting, in use, dirt
5 and dust which has been separated from the airflow and wherein part of the chamber wall in the region of the collection area is a closure member which is movable between a closed position in which the closure member seals the chamber and an open position in which dirt and dust can escape from the collection area, the chamber further comprising releasing means for releasing the closure member from the closed position,
10 the releasing means comprising a manually operable actuating member and an agitator for agitating dirt held within the collection area, wherein the agitator is operable by the actuating member.
2. A collecting chamber according to claim 1 wherein a linking mechanism couples
15 the actuating member to the closure member and wherein the agitator is mounted on the linking mechanism.
3. A collecting chamber according to claim 2 wherein the agitator comprises at least one fin which extends outwardly from the linking mechanism into the collection
20 area.
4. A collecting chamber according to claim 3 wherein the agitator comprises a plurality of fins which are spaced around the circumference of the linking mechanism, each fin extending radially outwardly from the linking mechanism into the collection
25 area.
5. A collecting chamber according to claim 2 wherein the agitator is arranged such that it can rotate about the linking mechanism as the actuating member is operated.
- 30 6. A collecting chamber according to any one of the preceding claims wherein the releasing means is operable to apply an opening force to the closure member.

7. A collecting chamber according to any one of the preceding claims wherein the actuating member is located at an opposite end of the separator to where the closure member is located.
- 5 8. A collecting chamber according to any one of the preceding claims further comprising a handle for carrying the separator and wherein the actuating member is located adjacent the handle.
- 10 9. A collecting chamber according to claim 8 wherein the actuating member is a trigger mechanism which is located beneath the handle.
- 10 10. A collecting chamber according to any one of the preceding claims wherein the closure member is lockable in the closed position.
- 15 11. A collecting chamber according to claim 10 wherein the closure member is automatically locked as the closure member is moved towards the closed position.
- 20 12. A collecting chamber according to claim 11 wherein the lock is resiliently mounted such that it can be temporarily displaced by the closure member as the closure member is moved towards the closed position.
- 25 13. A collecting chamber according to any one of the preceding claims wherein the closure member is pivotably fixed to the chamber.
- 30 14. A collecting chamber according to any one of claims 1 to 12 wherein the closure member is slideably movable with respect to the chamber.
15. A collecting chamber according to any one of the preceding claims wherein the closure member carries a seal for sealing against the part of the collection area in which it is fitted.

16. A collecting chamber according to any one of the preceding claims wherein the closure member forms a surface against which dirt and dust can collect during operation of the cleaner.
- 5
17. A collecting chamber according to claim 16 wherein the closure member forms a base of the separator.
18. A collecting chamber according to any one of the preceding claims wherein the separator is a cyclonic separator.
- 10
19. A collecting chamber according to claim 18 further comprising a second stage separator and a second stage collection area, and wherein both the second stage and first stage collection areas lie adjacent the closure member.
- 15
20. A collecting chamber according to claim 19 wherein the second stage collection area lies within the first stage collection area.
21. A collecting chamber according to claim 20 further comprising a wall which separates the second stage collection area from the first stage collection area.
- 20
22. A vacuum cleaner incorporating a collecting chamber according to any one of the preceding claims.
- 25
23. A collecting chamber for a vacuum cleaner or a vacuum cleaner incorporating a collecting chamber substantially as described herein with reference to the accompanying drawings.



INVESTOR IN PEOPLE

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Claims searched: 1-23

Examiner: John Wilson
Date of search: 10 May 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): A4F

Int Cl (Ed.7): A47L 9/16

Other: Online:- WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2317122 A Notetry - whole document	
A	US 5145499 Notetry - whole document	
A	US 5090976 Notetry - whole document	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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